

What is claimed is:

1. An automotive passenger restraint and protection apparatus for an automotive vehicle, having a seatbelt, for restraining an occupant of the automotive vehicle by the seatbelt to protect the occupant, comprising:

5 danger degree determining means for determining a degree of danger of collision of the automotive vehicle;

danger predicting means for predicting a possibility of collision of the automotive vehicle, from the degree of danger determined by said danger degree determining means;

10 collision danger signal generating means for generating a collision danger signal when the possibility of collision is predicted by said danger predicting means;

15 driving means responsive to said collision danger signal, for carrying out alternate retraction and protraction of the seatbelt;

deceleration detecting means for detecting deceleration of the automotive vehicle; and

20 seatbelt driving control means for controlling said driving means so as to continue the alternate retraction and protraction of the seatbelt without stopping same after said collision danger signal ceases to be generated and until the deceleration of the automotive vehicle detected by said deceleration detecting means exceeds a predetermined value.

2. An automotive passenger restraint and protection apparatus for an automotive vehicle, having a seatbelt, for restraining an occupant of the automotive vehicle by the seatbelt to protect the occupant, comprising:

5 a motor for retracting and protracting the seatbelt;

seatbelt attaching state detecting means for detecting whether the seatbelt is in a state attached to the occupant or in a state disconnected from the occupant;

danger degree detecting means for detecting a significant

10 degree of danger of collision of the automotive vehicle; and
control means for controlling said motor so as to retract
the seatbelt to a limit thereof and then protract the seatbelt
to thereby give a predetermined amount of looseness to the
seatbelt,

15 wherein said control means controls said motor so as to
give a first predetermined amount of looseness to the seatbelt
when the significant degree of danger is not detected by said
danger degree detecting means while the seatbelt is detected
to be in said state attached to the occupant, and controls
20 said motor so as to give a second predetermined amount of
looseness to the seatbelt which is smaller than said first
predetermined amount of looseness when the significant degree
of danger is detected by said danger degree detecting means
while the seatbelt is detected to be in said state attached to
25 the occupant.

3. An automotive passenger restraint and protection
apparatus as claimed in claim 2, wherein said danger degree
detecting means comprises at least one of vehicle speed
detecting means for detecting traveling speed of the
5 automotive vehicle, braking detecting means for detecting
stepping-on of a brake pedal of the automotive vehicle,
steering angle change rate detecting means for detecting a
rate of change in a steering angle of the automotive vehicle,
ambient illuminance detecting means for detecting ambient
10 illuminance of the automotive vehicle, and raindrop detecting
means for detecting raindrops on the automotive vehicle, said
danger degree detecting means detecting the significant degree
of danger if said vehicle speed detecting means detects that
the traveling speed of the automotive vehicle is higher than a
15 predetermined value and at the same time at least one of
conditions is satisfied that the stepping-on of the brake
pedal is detected by said braking detecting means, the
steering angle change rate detecting means detects that the

20 rate of change of the steering angle exceeds a predetermined value, the ambient illuminance detecting means detects that the ambient illuminance of the automotive vehicle is below a predetermined value, and the raindrop detecting means detects the raindrops on the automotive vehicle.

4. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 braking detecting means for detecting a stepping-on force of a brake pedal of the automotive vehicle or stepping-on speed thereof, said control means controlling said motor such that rotational speed of said motor in retracting the seatbelt is higher as the stepping-on force or the stepping-on speed
10 detected by said braking detecting means is larger, when the traveling speed of the automotive vehicle detected by said vehicle speed detecting means is higher than a predetermined value.

5. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 braking detecting means for detecting stepping-on of a brake pedal of the automotive vehicle, said control means controlling said motor such that rotational speed of said motor in retracting the seatbelt is higher as the traveling speed of the automotive vehicle detected by said vehicle speed
10 detecting means is higher, when the detected traveling speed is higher than a predetermined value and at the same time the stepping-on of the brake pedal is detected by said braking detecting means.

6. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 steering angle change rate detecting means for detecting a rate of change in a steering angle of the automotive vehicle, said control means controlling said motor such that rotational speed of said motor in retracting the seatbelt is higher as the rate of change in the steering angle detected by said
10 steering angle change rate detecting means is larger, when the traveling speed of the automotive vehicle detected by said vehicle speed detecting means is higher than a predetermined value.

7. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 steering angle change rate detecting means for detecting a rate of change in a steering angle of the automotive vehicle, said control means controlling said motor such that rotational speed of said motor in retracting the seatbelt is higher as the traveling speed of the automotive vehicle detected by said
10 vehicle speed detecting means is higher, when the detected traveling speed is higher than a predetermined value and at the same time the rate of change in the steering angle detected by said steering angle change rate detecting means is larger than a predetermined value.

8. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 ambient illuminance detecting means for detecting ambient illuminance of the automotive vehicle, said control means

controlling said motor such that rotational speed of said motor in retracting the seatbelt is higher as the ambient illuminance detected by said ambient illuminance detecting means is smaller, when the traveling speed of the automotive vehicle detected by said vehicle speed detecting means is higher than a predetermined value.

9. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and ambient illuminance detecting means for detecting ambient illuminance of the automotive vehicle, said control means controlling said motor such that rotational speed of said motor in retracting the seatbelt is higher as the traveling speed of the automotive vehicle detected by said vehicle speed detecting means is higher, when the detected traveling speed is higher than a predetermined value and at the same time the ambient illuminance detected by said ambient illuminance detecting means is smaller than a predetermined value.

10. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and raindrop detecting means for detecting raindrop on the automotive vehicle, said control means controlling said motor such that rotational speed of said motor in retracting the seatbelt is higher as the traveling speed of the automotive vehicle detected by said vehicle speed detecting means is higher, when the detected traveling speed is higher than a predetermined value and at the same time the raindrops are detected by said raindrop detecting means.

11. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 braking detecting means for detecting a stepping-on force of a brake pedal of the automotive vehicle or stepping-on speed thereof, said control means controlling said motor such that an amount of protraction of the seatbelt is smaller as the stepping-on force or the stepping-on speed detected by said
10 braking detecting means is larger, when the traveling speed of the automotive vehicle detected by said vehicle speed detecting means is higher than a predetermined value.

12. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 braking detecting means for detecting stepping-on of a brake pedal of the automotive vehicle, said control means controlling said motor such that an amount of protraction of the seatbelt is smaller as the traveling speed of the automotive vehicle detected by said vehicle speed detecting
10 means is higher, when the detected traveling speed is higher than a predetermined value and at the same time the stepping-on of the brake pedal is detected by said braking detecting means.

13. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 steering angle change rate detecting means for detecting a rate of change in a steering angle of the automotive vehicle, said control means controlling said motor such that an amount of protraction of the seatbelt is smaller as the rate of

16. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 ambient illuminance detecting means for detecting ambient illuminance of the automotive vehicle, said control means controlling said motor such that an amount of protraction of the seatbelt is smaller as the traveling speed of the automotive vehicle detected by said vehicle speed detecting
10 means is higher, when the detected traveling speed is higher than a predetermined value and at the same time the ambient illuminance detected by the ambient illuminance detecting means is smaller than a predetermined value.

17. An automotive passenger restraint and protection apparatus as claimed in claim 2, wherein said danger degree detecting means comprises vehicle speed detecting means for detecting traveling speed of the automotive vehicle, and
5 raindrop detecting means for detecting raindrops on the automotive vehicle, said control means controlling said motor such that an amount of protraction of the seatbelt is smaller as the traveling speed of the automotive vehicle detected by said vehicle speed detecting means is higher, when the
10 detected traveling speed is higher than a predetermined value and at the same time the raindrops are detected by said raindrop detecting means.

change in the steering angle detected by said steering angle
change rate detecting means is larger, when the traveling
speed of the automotive vehicle detected by said vehicle speed
detecting means is higher than a predetermined value.

14. An automotive passenger restraint and protection
apparatus as claimed in claim 2, wherein said danger degree
detecting means comprises vehicle speed detecting means for
detecting traveling speed of the automotive vehicle, and
steering angle change rate detecting means for detecting a
rate of change in a steering angle of the automotive vehicle,
said control means controlling said motor such that an amount
of protrusion of the seatbelt is smaller as the traveling
speed of the automotive vehicle detected by said vehicle speed
detecting means is higher, when the detected traveling speed
is higher than a predetermined value and at the same time the
rate of change in the steering angle detected by said steering
angle change rate detecting means is larger than a
predetermined value.

15. An automotive passenger restraint and protection
apparatus as claimed in claim 2, wherein said danger degree
detecting means comprises vehicle speed detecting means for
detecting traveling speed of the automotive vehicle, and
ambient illuminance detecting means for detecting ambient
illuminance of the automotive vehicle, said control means
controlling said motor such that an amount of protrusion of
the seatbelt is smaller as the ambient illuminance detected by
the ambient illuminance detecting means is smaller, when the
traveling speed of the automotive vehicle detected by said
vehicle speed detecting means is higher than a predetermined
value.